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What is sustainability in the wine world? A cross-country analysis of wine sustainability frameworks

Shana Sabbado Flores

Federal Institute of Education, Science and Technology of Rio Grande do Sul (IFRS), Rua Alberto Hoffmann 285, CEP 91791-508, Porto Alegre, RS, Brazil

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ABSTRACT

Sustainability is a paradigm that affects many sectors due to an increasing of stakeholders' pressure, economic or political reasons. The wine industry is concerned about sustainability in both senses: it confronts threats from sustainability issues, such as climate change, chemical exposure and water and energy availability and its activities have their own impacts. In this sense, understanding sustainability in the wine world requires identifying definitions and principles, but also a review of current practices. This paper sets forth a cross-country analysis about current sustainability assessment frameworks in six countries (South Africa, Australia, New Zealand, US, Chile and France) in order to identify their main aspects, drivers and issues. A cross-analysis discusses the presentation, the scale, the scope, the governance, the deepness, the learning potential and the content, in a cross-disciplinary perspective. The common grounds are summarized in terms of main indicators linked with official guidelines. Most of the frameworks are certifications or labels in voluntary programs, using a qualitative approach to check compliance with guidelines, without proposing the improvement of sustainability performance. They are more focused on operation and on mitigating impact. All frameworks have indicators considering the main environmental issues to the wine industry. The frameworks development should move toward a more effective proposition for improving wine sustainability, in order to answer to the operational challenges with a strategic thinking. The analysis performed can contribute to the development of sustainability programs, improve current methods and encourage the diffusion of sustainability practices to the individuals or in terms of national programs.

1. Introduction

Due to an increasing pressure from customers and markets, for economic or political reasons, sustainability is a paradigm that affects many sectors. It is a relative consensus that to deal with sustainability is a necessary challenge, imposed to all society's sectors, considering the environmental degradation and its social consequences that affect even the economic dimension. However, even if the modern sources of this debate dates from the 1950s, further progress is required in this sense. In this context, sustainability assessment is not only an essential but also a difficult matter; it involves making choices about how to define and measure sustainability, and for how long (Flores, 2014).

The wine industry is concerned about sustainability issues in both senses: it confronts threats from sustainability issues, such as climate change, chemical exposure and water and energy availability (Aigrain et al., 2016; Gilinsky et al., 2016) and, at the same time, its activities and their own impacts are not well explored by literature (Barber et al., 2009; Christ and Burritt, 2013). On the other hand, in this industry sustainability can also be a competitive factor, a driving market strategy and a key to innovation process (Fiore et al., 2016; Nidumolu et al., 2009).

Concerning market relationship, empirical works have shown that customers are sensitive to the concept of sustainable wine-making and there is a trend for wines that have been produced using sustainable practices in customer choices. Besides, the customer tends to conclude that wine quality is improved by sustainable practices even if customers do not have a clear idea about what it means in practice (Forbes et al., 2009; Schäufele and Hamm, 2017; Zucca et al., 2009). In addition, results indicate a willingness to pay higher prices for the products identified with sustainability (Barber et al., 2010; Forbes et al., 2009; Sogari et al., 2016; Zucca et al., 2009).

E-mail address: shana.flores@ifrs.edu.br.

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From the producers' perspective, a cross-analysis in seven countries showed that producers can identify advantages in adopting sustainable practices, mainly in the environmental dimension underscoring improvement in quality and economic efficiency from eco-efficiency practices; besides, producers do not always have a clear idea about the differences between sustainable agricultural approaches, i.e., sustainable, organic or biodynamic (Szolnoki, 2013). Additionally, empirical studies have shown internal motivation as main drive to adopt sustainability practices and voluntary standards, even if the economical results tend to be better to this stakeholders (Gabzdylova et al., 2009; Giacomarra et al., 2016; Santiago-Brown et al., 2014; Santini et al., 2013).

Answering what sustainability in the wine world is requires understanding definitions and principles, but also a review of current practices. In the wine world, the notion of sustainable viticulture is supported by official documents from the International Organization of Vine and Wine (OIV), which include definition (OIV, 2004), guidelines (OIV, 2008) and general principles (OIV, 2016). At the same time, wine regions have been creating their own frameworks, presented as national (or regional) programs or frameworks in order to adapt sustainability in their contexts and deal with local issues. Sustainable viticulture frameworks can be considered an answer from wine territories to customers and markets, a way to systematize current practices or an initiative to improve wine management and promote innovation processes. Moreover, the frameworks are a way of positioning the wine territory.

This paper sets forth a cross-country analysis about current frameworks used to sustainability performance assessment or to guide implementation of sustainability programs in the wine industry in six countries (South Africa, Australia, New Zealand, US, Chile and France) in order to identify their main aspects, drivers and issues. The main research about sustainability in the wine industry management, as it could be observed, is focused on customer or producer perception and positioning about this issue. Besides, some papers discuss about drivers to sustainability in the wine industry (Santini et al., 2013) or sustainability and wine tourism (Barber et al., 2009; Dodd, 1995; Fountain and Tompkins, 2011; Taylor et al., 2010). With regard to sustainability frameworks, some authors make an effort to analyze initiatives (Corbo et al., 2014; Pierot and Rochard, 2013; Pratt, 2012; Santiago-Brown et al., 2014), but the surveys are more focused on describing the frameworks or on analyzing history, drivers and scope than on observing the content and topics covered. This paper aims at answering this lack of initiatives, observing frameworks of six countries in a cross-analysis perspective, which allows a comparison in terms of structure, scale, scope, deepness and content, on the same basis. Another contribution is to draw attention to common grounds and main guidelines and indicators used by sustainability frameworks. This paper is addressed to winemakers, producers, customers, researchers and stakeholders interested in improving sustainability in the wine industry.

2. Background

This section is organized to present concepts and definitions connected with sustainability in the wine industry and to provide an overview of background research on sustainability assessment and frameworks.

2.1. Concepts and definitions about sustainability in wine

The discussion of sustainability in the wine industry raises many concerns, starting with agricultural activities (viticulture), followed by industrial operations and management processes (winery) and the distribution. Furthermore, the enhancing of wine tourism in an international context emphasizes other issues to this discussion.

In terms of agriculture, the Food and Agriculture Organization of the United Nations (FAO) has adopted, since 1989, a concept of "sustainable agriculture and rural development" based on environmental conservation (soil, water and animal and vegetal genetic resources), economic viability and social acceptance (FAO, 1997) – aligned with the most-known concept of sustainable development from Report of Brundtland and the three pillars (or dimensions) of sustainable development: environmental, social and economic (United Nations, 1987).

The sustainability in the wine industry has been an important subject to the International Organization of Vine and Wine (OIV), which is institutionalized by official documents. Sustainable viticulture was firstly defined by the Resolution CST 1/2004 as a "global strategy on the scale of the grape production and processing systems, incorporating at the same time the economic sustainability of structures and territories, producing quality products, considering requirements of precision in sustainable viticulture, risks to the environment, product safety and consumer health and valuing of heritage, historical, cultural, ecological and aesthetic aspects" (OIV, 2004). This definition was improved by the Resolution CST 1/2008, which indicates guidelines for environmental assessment in terms of production, processing and packaging: (1) site selection (for new vineyards/wineries); (2) biodiversity; (3) variety selection (for new vineyards); (4) solid waste; (5) soil management; (6) energy use; (7) water management; (8) air quality; (9) wastewater; (10) neighboring land use; (11) human resource management; (12) agrochemical use (OIV, 2008).

Most recently, the Resolution 1/2016 establishes the OIV General Principles of Sustainable Vitiviniculture, including environmental, social, economic and cultural aspects (OIV, 2016). The document develops the aspects and guidelines defined in the earlier Resolutions from the work of technical commission and expert groups. In addition to that, it can be mentioned other initiatives during this period focused on specific issues, such as traceability (OIV, 2007) or greenhouse account and carbon footprint in the wine industry (OIV, 2015, 2011, 2010).

Analyzing the definition from OIV, in terms of scope, it can be identified the classical tripod of sustainability, but also other important issues to the wine world, like the combination of environmental and subjective aspects. The social has a wide approach emphasizing immaterial topics, such as heritage, history and culture. This idea evinces some special issues to the wine industry in a context in which immaterial aspects play an important role in terms of tradition, reputation and landscape valorization (Flores, 2014).

It is interesting to observe that both concepts of sustainability applied to agriculture and viticulture do not treat the organic (or biodynamic) agriculture as a synonym of sustainable agriculture (or viticulture). This point appears in many studies, with different scenarios, objectives and constructions (Boulanger-Fassier, 2008; Flores, 2015; Pratt, 2012; Szolnoki, 2013; Thrupp, 2014). In general, studies indicate that sustainable viticulture and agricultural systems (integrated, organic or biodynamic production) can be complementary in their scope, but they are different concepts. This idea can be confirmed by the official definitions presented and in the public (customer and producer) perception. This paper is based on the concept of sustainable viticulture from OIV; it is justified because most of the frameworks in wine sustainability do not use directly the concepts related with agricultural systems. These systems are a matter of specific labels that won't be reported in this work, focused on national or regional frameworks.

2.2. Sustainability assessment and frameworks

To bring sustainability principles into practice is a challenge in several areas, including research, public policies and company management. Beyond the definition of sustainability, it is necessary to establish the required or basic conditions, regarding objectives and metrics – the core of sustainability frameworks. The subject of sustainability assessment is as necessary as difficult; it has been enhanced quantitatively and qualitatively: the number of tools is increasing, at the same time as many of the frameworks have expanded their initial proposal to include support tools, such as application guidelines, data and case study experiences (Ness et al., 2007). This development can be seen for instance in the Compendium of Sustainable Development Indicator Initiative, a list including more than 500 frameworks that have been developed since the early 1990s (Böhringer and Jochem, 2007; IISD, 2013).

In terms of structure, we classify the sustainability frameworks in six types or categories (Table 1): (1) self-assessment, (2) footprint, (3) protocol, (4) guide and (5) certification or label. These categories were summarized considering the general proposition or presentation of the framework, the type of indicators used (quantitative and/or qualitative), the assessment method and certification or compliance rules. In addition to that, in terms of scope, some frameworks are more comprehensive, trying to have a more complete view about sustainability issues, while others are focused on a specific topic. In respect of categories, both cases are considered as sustainability frameworks because, in general, the frameworks can be used individually or in synergy with others, in order to complete the weakness related with scope or deepness, for instance.

In case the frameworks try to bring sustainability assessment in objective terms, it is therefore clear that the definition of rules and indicators is directly related to the chosen sustainability approach, thus the indicators and rating systems are also influenced by subjectivity (Hezri and Dovers, 2006). Some key requirements in sustainability frameworks scope are, according to Böhringer and Jochem (2007), the rigorous connection with sustainability definitions, the selection of significant indicators about holistic fields, the reliability and availability of data for time horizons, the preference for process- oriented indicators and possibility of unfolding political objectives or sub-objectives.

There are many reasons for using sustainability frameworks, including, decision making and management process, promotion, participation and consensus construction or research and analysis (Parris and Kates, 2003). In addition to that, most of the time sustainability is also an operational challenge, which drives companies adopt check-list approach based on a standard set of social and environmental risks, such as GRI (GRI, 2016; Porter and Kramer, 2006). The use of frameworks and indicators is a way to read and interpret reality, at the same time that they allow a comparison in respect of contexts or over time. Furthermore, they are important tools to communicate with stakeholders and to make commitments for continuous improvement in sustainability performance.

If sustainability is the search for balance, it requires a dialogue between current and future needs and also stakeholders' expectations. Thus, it is important to understand customers, markets and society while being meaningful to producers. In this sense, the sustainability strategy should be aligned with the main criteria and guidelines of producer strategy, in order to enhance competitive advantage (Porter and Kramer, 2006, 2002). The main drives moving wine industry toward sustainability strategies are internal motivation and stakeholders' concerns (Capri et al., 2013; Corbo et al., 2014; Gabzdylova et al., 2009; Giacomarra et al., 2016; Santiago-Brown et al., 2014; Santini et al., 2013). The internal motivations are basically strategic choices that can be motivated by ethical reasons, operations efficiency or marketing positioning. The stakeholders can drive initiatives in different fields according to their concerns, which include regulation social and environmental and issues, highlighting water, impact upon community, chemicals, waste, land use, energy and greenhouse gases.

In the last period, the number of initiatives and tools to assess sustainability performance or to guide programs in the wine industry has been growing significantly. The frameworks applied to the wine industry can be classified into two categories: general frameworks or national (or regional) programs. Considering the general frameworks, the wine industry has been using the same methodologies applied to other sectors, such as the ISO standards, the GRI sustainability reports and/or the footprints. The ISO 14001, the main standards to certify Environmental Management Systems are popular in many wine regions, in particular the US, New Zealand and some producers from Europe (Christ and Burritt, 2013; Corbo et al., 2014; Hughey et al., 2005; Iannone et al., 2016; ISO, 2015; Pierot and Rochard, 2013). The general frameworks can be used alone or as part of regional programs. Besides, research concerning life-cycle approaches has been enhanced, including Life Cycle Assessment (LCA) and the footprints (Christ and Burritt, 2013; Iannone et al., 2016; Penavayre et al., 2016; Rugani et al., 2013).

On the other hand, wine regions have developed their own frameworks with a significant level of complexity, which become national (or regional) programs to sustainability. These programs have a comprehensive approach using guidelines and indicators linked with environmental, social and economic dimension to assess activities from vineyards, winery operations and management process (Santiago-Brown et al., 2014). Despite that it can be applied in a specific context, these programs have a dialogue with general frameworks: they can use similar criteria and scope or adopt general frameworks as part of the regional program.

Many wine regions around the world have proposed sustainability programs, mainly in the producers knowed as “New World”, highlighting South Africa, Australia, New Zealand, US and, more recently, Chile (Pierot and Rochard, 2013; Pratt, 2012; Santiago-Brown et al., 2014). In the “Old World” wine countries,

Table 1
Sustainability frameworks general forms.

Categories	Description
Self-assessment	in general, voluntary standards that establish guidelines and indicators in order to provide knowledge of the current situation to plan future actions; self-assessment frameworks may include a database with best-practices, allowing benchmarking
Footprints	a type of self-assessment that allows to convert the notion of sustainability in a quantitative approach; they have become popular with companies and public because it is a notion easy to understand, apply and communicate
Protocol	methodological proposals which allow for monitoring and evaluation, they have a more robust methodological proposal in comparison with self-assessments
Guide	systematization of guidelines, indicators, and practices that act as suggestions for working with the theme; the guides are reference material which can allow for self-assessment; in their essence, they are not certifiable.
Certifications or Labels	these standards are auditable to prove compliance to established procedures; they can be based on guides, protocols, assessment or footprint

it can be found interesting experiences in France, Italy and Switzerland, but in general these initiatives are fragmented to a specific public or they are not focused on format a regional program. In France, for example, an important ongoing initiative is to include sustainability criteria in the Geographical Indicators, which answer by more than 90% of French wine production (Gautier, 2016).

The national programs are an interesting proposition in order to deal with local issues concerning wine sustainability. They put sustainability into a context, considering institutions, regulations, policy and stakeholders' concerns contributing to positioning wine region and enhance competitive advantage. However, this format does not propose a common basis allowing to compare sustainability performance in different regions, which can be confusing to the customers' point of view. Meanwhile, even if most of the time the national (or regional) programs are voluntary, they can engage satakeholders and set goals to improve sustainability performance which is relevant (Santiago-Brown et al., 2014). More about wine sustainability framework is explored in the following sessions.

3. Materials and methods

This section aims at presenting the frameworks chosen and the criteria used to conduct the analysis. This cross-country study is based on a qualitative method, using as main data source literature review and document search, which was completed by contact with experts (Bowen, 2009; Crabtree and Miller, 1999). The study was structured in two phases: (1) exploratory study to select the main countries or regions in terms of wine sustainability; (2) content analysis of sustainability frameworks.

In the first phase, the literature review and contact with experts were used to identify current wine sustainable initiatives and to support the selection of six reference countries (or regions) and eight frameworks. The opinion of five experts on the field was used to validate de selection; they were consulted by semi-structured interviews. The identification of participants' names and characteristics are reserved in order to preserve confidentiality commitments.

The second phase has analyzed the frameworks using data and information collected from official documentation (i.e. manuals, guides, reports, data sheet, etc.) and informative material and website of each program or framework (Bowen, 2009). Content analysis was used to explore and systematize information collected (Bardin, 2013). In both phases, the analysis was validated using triangulation through multiple data sourcing from literature review and primary data from the experts. Based on the triangle analogy, the triangulation is a strategy for validation frequently used in qualitative research that implies looking at the same research question from more than one source of data, helping to minimize subjectivity (Decrop, 1999; Flick, 2004; Jonsen and Jehn, 2009).

Some surveys complement the data collection with primary data from interviews with participants or stakeholders. In this paper the main goal was to analyze frameworks' scope, structure and content, which was supported adequately by the sources consulted. Further works can expand the current analysis using primary sources.

3.1. Overview of selected frameworks to wine sustainability

This study examined six countries (or wine regions) considered reference in terms of sustainable viticulture (such as, Pierot and Rochard, 2013; Pratt, 2012; Santiago-Brown et al., 2014) by literature and validate by the experts consulted.

As explained in the introduction of this section, the research started with a literature review, in order to overview the state of art of sustainability initiatives in wine sector. The main criteria to select these six countries and eight frameworks considered frameworks: institutionalized and supported by national or regional institutions, part of membership programs, geographically organized in a broad scale (representing national programs, preferably) and data availability. The frameworks selected are mainly process-based and applied to companies. Six countries were considered references. In the case of the United States and Australia, the research considered a specific wine region, which can be justified by the size and the positioning in terms of sustainability in wine industry context. In each country (or region) the main frameworks were identified. Table 2 shows the frameworks analyzed.

The frameworks chosen cover a wide range, in terms of geographical distribution and production profile. The selection has examples from the two hemispheres, four continents, old and new producers. Together, the countries selected answer for more than 74000 hL and 28% of world wine production; five of them are part of top 10 world producers (OIV, 2014). Even if the objective was not an exhaustive survey, the sample diversity supports, in qualitative terms, an overview about the topic.

The only country where was considered more than one framework was South Africa, because of the specificities in terms of structure and governance. The other initiatives observed are programs, whose strategic directives are unfolded into indicators or parameters. In the case of South Africa, the IPW and BWI are independent frameworks, with significant differences, underlying scale, scope and governance. The SWSA was launched later to integrate initiatives already established; the program, at the same time, can be used as a label ("integrity & sustainability") to indicate compliance with IPW, but also as strategic instance to articulate sustainability programs (such as BWI). Even if SWSA is an integrative instance and could be considered in this paper to represents SA, the analysis of the initiatives individually allows a better understanding of the whole program, while highlights specificities in each initiative; in addition to that, observing the three initiatives was considered more adequate in the context of this paper, which is focused on the analysis of frameworks.

It can be noted that most part of the frameworks selected come from "New World" wine producers. It doesn't mean that "Old World" wine producers don't have sustainability initiatives. The research has identified several initiatives, but most part are focused on specific public or agricultural systems (such as programs to organic farming). A study about environmental sustainability programs in Italy, for instance, have identified ten initiatives with different scope and structure (Corbo et al., 2014), which demonstrate the diffusion of sustainability initiatives. This context makes difficult the election of a national reference, part of the criteria in this research.

It is clear that "Old World" producers have interesting initiatives that can be better analyzed by further works. In the case of France, even if several initiatives could be identified in regional level (such as programs in Champagne and Bordeaux), the paper points Terra Vitis, a program with national scale. Above all, the aim of this paper was not an exhaustive state of art of wine sustainable frameworks, but an overview in terms of the main initiatives and to propose criteria for further analyses that can expand this sample.

Finally, sustainability cannot be separated of the context, mainly in complex subjects such as wine world, which put in evidence local and territorial issues (e.g. environmental issues, culture and heritage, landscape). Also, it is a matter of finding consensus and setting priorities, whether for companies, collectivities or countries. In this sense, the analysis of current frameworks is not intended to indicate a model or a best framework which can be adopted around the world, but to systematize references, providing basis to other countries develop their own initiatives, connecting global references with local context.

Table 2
Wine sustainability frameworks analyzed.

	Framework	Scope
South Africa	Sustainable Wine South Africa (SWSA)	Initiative that integrates South Africa Sustainable Programs (IPW and BWI) and institutions. The program proposes the "Integrity and Sustainability", a label used for traceability and to identify compliance with IPW criteria. (SWSA, 2013)
	Integrated Production of Wine (IPW)	Established in 1998, this voluntary program includes traceability, integrated production and sustainable practices in farms and cellars. The standard has wide scope and specific evaluation topics, such as agricultural practices and chemicals use. In addition, covers topics such as emissions, energy, water, waste management, traceability and wine quality criteria. Approximately 95% of total production is certified by IPW, which represents 75% of winegrowers. (IPW, 2013, 2008, 2006)
	Biodiversity & Wine Initiative (BWI)	Partnership between the wine industry and WWF to conserve Cape Floral Kingdom and its remaining natural areas. This site is concentrate 95% of SA vineyards and it is a hotspot to biodiversity loss. The initiative has reached over 130000 ha of natural area preserved, which is over than 1ha preserved per vineyard hectare (WWF, 2013).
New Zealand	Sustainable Winegrowing New Zealand (SWNZ)	National program since 2002 which goal is to include 100% of the New Zealand Wine Industry; it is a guide that details a model of best practices in vineyards and wineries. The standard is based in six dimensions (biodiversity, soil, air and water, energy, chemicals, sub products, people and business practice), each one has "main practices" that are mandatory and "REC/BP," recommendations or best practices (SWZN, 2014, 2013).
Australia	McLaren Vale Sustainable Winegrowing Australia (MVSWGA)	Formally launched in 2009, it was the only program in sustainable wines in Australia, based on self-evaluation and continuous improvement. The standard based on six dimensions: soil health, fertility management and nutrition, pests and diseases management, biodiversity, water management, waste management and social relations. The program has reached 35% of winegrowers and 40% of vineyards in McLaren Vale. The program is under EntWine, the Australian "umbrella" sustainability program (MVSWGA, 2013a, 2013b, 2012).
Chile	National Code of Sustainability for Chilean Wine Industry	Developed by the consortium Wines of Chile from 2007, this program was launched in 2011 and certifies vineyards, wineries and management practices. The main guidelines are: agricultural management, chemicals and water resources protection, to vineyards; energy, water and waste management, to wineries; ethic, environment, quality of life at work, community and marketing and customer compromise, in management practices (Vinos de Chile, 2014).
US/California	California Sustainable Winegrowing Alliance (CSWA)	This program includes a long and detailed guide (California Code of Sustainable Winegrowing Workbook) and training program. Also, the participants can label their practices through Certified California Sustainable Winegrowing (CCSW). The code has 138 self-assessment topics to vineyards and wineries, the certification requires 50 of them to vineyards and 32 to wineries. The code is structured in 15 chapters: sustainable business strategy, viticulture, soil management, vineyard water management, pest management, wine quality, ecosystems management, energy efficiency, winery water conservation and quality, material handling, solid waste reduction and management, environmentally preferred purchase, human resources, neighbors and community, air quality. Even if the certification reaches just 14% of total surface it represents 57% of wine box produced (CSWA, 2013, 2012).
France	Terra Vitis	Recognized by the French Agricultural Ministry, this program uses directives from integrated production. The National Federation Terra Vitis (FNTV) groups five local associations responsible for adapting and managing the program: Burgundy-Beaujolais, Loire, Bordeaux, Champagne and Rhone-Mediterranean. The main topics are: traceability, security and health, agricultural practices, chemicals biodiversity and landscape, winery and framework support (FNTV, 2013; TVBB, 2012).

Source: adapted from Flores and Medeiros (2016)

3.2. Cross-analysis criteria

The cross-analysis use criteria to evaluate the frameworks in terms of form and content. The criteria are summarized in Tables 3 and 4.

The first criterion was discussed in Section 2.1 and it is focused on the main goal or presentation form of the framework. In terms of scale, the topic classifies in national or regional frameworks, which is interesting to analyze politic articulation level. Governance is considered important to the extent that it points the responsibility to framework management and application. Most of the time, national programs concern official institutions, with national representation, which tend to develop programs based on the work of experts and aligned with public policies; while the framework passes for a Regional Association (or federation), the proposal is likely to come from an engagement or local understanding and the presence, and participation of stakeholders tend to be stronger. On the other hand, there is also the work of external agents that can be civil society organizations, engaged in a specific topic, or companies that act as certifiers (Flores, 2015).

In terms of deepness, it is undeniable that, despite all the frameworks cover sustainable wine principles; some bring a level of demand and detailing much higher than others. Thus, this criterion aims to differentiate proposals that point guidelines from others that include specific performance objectives. The deepness can be classified in guidelines, indicators and parameters, following the proposal of the methodological framework MESMIS. In its evaluation structure, MESMIS proposes the adoption of "descriptors" (or guidelines), which are characteristics or general properties, supported by "indicators", responsible for measuring changes in system descriptors. As a means of control "parameters" indicating limits for indicators are defined (Cândido et al., 2015; GIRA, 2012).

The learning potential reflects the capacity of each framework, to act as inducing factor of learning and improving practices. In previous research, specialists and wine growers have described sustainability as a concept that evolves in the time and pointed that to be sustainable requires continuous improvement (Flores, 2015). In the most of times, criteria to cross-analysis frameworks consider topics related to scope, content and structure (such as Ness et al., 2007; Singh et al., 2009). During this analysis, it was considered important to observe in which extend the frameworks could encourage improvement, the learning potential.

This capability is possible, not only through exposure and awareness of the problem, but the potential to bring solutions and suggest improvements, to point out ways to transform sustainability principles into actions or to improve practices already in place. This analysis is based on the literature review and document research to propose three level of learning potential (high, medium and low). The criteria have considered content, deepness and assessment method. The content considers the extension of topics covered by each framework as well as the deepness retrieve frameworks' structure into guidelines, indicators and/or parameters. The content analysis is considered important to define learning potential because it allows a more comprehensive view of sustainability, not reducing it to specific issues.

The assessment method took into account some of the factors that can contribute to a higher learning potential, such as, the

Table 3
Form analysis criteria.

Criteria	Description	Category
Type	Represents the main goal of the framework (see Table 1)	• Self-assessment • Labels (or certifications) • Guide • Protocol
Scale	Territorial scope of the proposal in terms of design and implementation.	• National • Regional
Governance	Primary responsibility for planning, conducting and application policy.	• National • Regional association (or federation) • External
Deepness	How and to what extent the protocol is organized to process the data and information.	• Guidelines (G) • Indicators (I) • Parameters (P)
Learning potential	It reflects the ability of the proposal to promote learning and improvement in practices, which can occur, for example, by comparison with other analyzed stakeholders, continuous improvement requirements for next cycles or availability of guides, examples and best practices.	• High • Medium • Low

Table 4
Content analysis criteria.

Content category	Topic
Conceptual	- economic sustainability of structures and territories - product quality and safety - heritage, historical, cultural, ecological and aesthetic aspects
Environmental management	- site selection - biodiversity - variety selection - solid waste - soil management - energy use - water management - air quality - wastewater - neighboring land use - human resource management - agrochemical use

possibility to situate their performance assessed with respect to other stakeholders, the presence of requirements for improvement in each cycle, or the availability of guides, examples and best practices. This analysis has limitations due to the difficult inherent to measure learning criteria and the lack of field research or contact with local stakeholders. Nevertheless, it was considered important to discuss this approach to encourage further works in this sense.

In terms of content, this analysis is based on the definition of sustainable viticulture from OIV. It was separated by two main categories to represent conceptual aspects and environmental management (Table 4). The first one is based on the definition itself, highlighting the main aspects. Nevertheless, the environmental management recovers the guidelines suggested, as it can be seen in Section 2.2.

4. Results and discussion

This section presents the main guidelines and topics that drive sustainability priorities and policy in each framework and country, proposing an overview about sustainability in the wine world. The analysis showed that, although six countries were involved, it could be seen a convergence in the topics covered. Besides, the section aims at pinpointing the main indicators in each theme selected from OIV official definition and guidelines.

4.1. Cross-country frameworks analysis

The overview of frameworks, regarding form and content, is summarized in Tables 5 and 6, respectively. In terms of presentation, it can be seen that most of the frameworks are certifications or labels in voluntary programs. The labels can be supported by specific guides, which complement the central rules. In South Africa, in addition to a comprehensive general framework, in terms of indicators and parameters, the initiative has extra guides to matters such as waste, biodiversity and emissions. California was classified as a guide, a label and a self-assessment because it is structured as a very detailed guide, in relation to the others, presenting practical examples and cases, as well as being eligible for certification. However the programs are voluntary, in some cases producers can be mandatory to access special conditions, such as in New Zealand (Santiago-Brown et al., 2014); also, South Africa and New Zealand require sustainability frameworks to exportation.

In another view, most of them are national programs with national governance, i.e., promoted by national institutions. In some cases, an independent organization is formed specifically to manage sustainability programs in wine production, from partnerships between official agencies and industry representatives, as in South Africa, where it was founded the SWSA, New Zealand, with SWNZ, and in the US, with the CSWA. In other situations, organizations and local associations take responsibility for the framework management, often transformed into program, with winegrowers and wineries, such as Australia and Chile. However, in France, the Terra Vitis is linked with regional Chambers of Agriculture, but united in a federation, seeking to ensure alignment practices.

Governance by external bodies occurs in partnership with international initiatives. At BWI, the partnership was established

Table 5
Overview of wine sustainability frameworks form.

Country	Frameworks	Type	Scale	Governance	Deepness[a]	Learning potential
South Africa	**Sustainable Wine South Africa** (SWSA)	Label	National	National	G, I & P	High
	Integrated Production of Wine (IPW)	Label	National	National	G, I & P	High
	Biodiversity & Wine Initiative (BWI)	Label	Regional	External	G, I & P	Low
New Zealand	**Sustainable Winegrowing New Zealand** (SWNZ)	Self-assessment	National	National	G & I	Medium
Australia	**McLaren Vale Sustainable Winegrowing Australia** (MVSWGA)	Self-assessment	Regional	Regional association	G, I & P	High
US/California	**California Sustainable Winegrowing Alliance** (CSWA)	Guide, Self-assessment & Label	Regional	Regional association	G, I & P	High
Chile	**Código National de Sustentabilidad**	Label	National	National	G & I	Medium
France	**Terra Vitis**	Label	Regional	Regional association & federation	G, I & P	High

[a] G: Guidelines; I: indicators; P: parameters.

with the WWF, which became responsible for the program driving with timely goal in reference to scope and areas. In this case, the partnership brings working method and aids regarding promotion. It can be noted, however, that such initiative with external governance are focused on more specific issues, which end up putting a step back in relation to the other, in the criterion learning potential.

The deepness highlights the types of indicators used and the detailing potential, i.e., the level of information considered (guidelines, indicators or parameters). Most of them use a qualitative approach and check compliance with guidelines, without proposing the improvement of sustainability performance. The frameworks use guidelines, and many of them do not get to determine parameters or use simple classifications – such as in BWI, which considers a minimum of natural vegetation preserved area. In most cases, the standards include criteria compliance and indicators series, for instance, if the producer keeps records of emissions and water and energy consumption, without going into quantify or limit values.

These characteristics reveal a check-list approach, which indicates that frameworks are more concerned with operational improvement and adopt a responsive strategy (Porter and Kramer, 2002). The main goal of responsive strategy is to mitigate impacts from industry, which is important, mainly in terms of environmental issues. At this point, the frameworks can be improved to a more strategic approach in order to create value to stakeholders and, at the same time, enhance competitive advantage and wine region positioning and strategy (Porter and Kramer, 2006, 2002). The frameworks closer to strategic issues are California and Chile: the first chapter of CSWA is "sustainable business strategy" while the National Code includes some proposals in the area "management system".

The presence of parameters is important both to monitor the frame as to enhance the engagement with objectives. In most cases, the parameters are part of certifications and criteria to check compliance, which is the case of the frameworks from South Africa, Terra Vitis (France) and CSWA (California/US). In this sense, the framework from Australia (MVSWGA) proposes an interesting approach. Because working with parameters, although not necessarily providing minimum or maximum limits, it considers the reported values and puts on a performance scale, making possible an assessment regarding the ideal of sustainable winegrowing defined in the standard and the average group performance. Thus, an individual performance assessment is made, but also the wine region as a whole.

As regards learning potential, it can be seen that learning potential does not mean label or certification, at least in the frameworks observed. In the cross-analysis, some factors can be related with a high learning potential: governance, deepness and content extent. All proposals that were considered to possess a high learning potential have national or regional governance (acting in the national and regional scales, respectively) and different information levels, from guidelines to parameters. In addition, frameworks considered high learning potential superior for the support material and the training provided, highlighting the CSWA that provides a complete guide with data, methods and several cases.

From the analysis, it can be observed that availability of information and practical examples as well as benchmarking with competition may be pillars to improve learning potential, allowing comparison with best practices and putting sustainability issues in a context with practical examples of improvement. On the other hand, sustainability can drive innovation process, so common goals and compliance with sustainability requirements can contribute to learning potential in the sense that it encourages to overcome operational challenges and adopt innovation (Kiron et al., 2013).

The hypothesis from this analysis is that the learning potential is not consequence of frameworks structure directly, but more related with stakeholders' engagement and their ability to improve the frameworks itself. In this sense, the relation between improvement in sustainability performance and development of sustainability scientific basis, methods and frameworks is being supported by literature (such as Leff, 2010, 2006). More specific in the wine context, field based surveys indicate the role of support institution and "champions" (driving people) as critical to the success of frameworks (Corbo et al., 2014; Giacomarra et al., 2016; Santiago-Brown et al., 2014). However, this hypothesis should be confirmed and better developed by future works using primary data.

In terms of contents, all of them have indicators to environmental issues, but economic and conceptual aspects are poorly considered. The main environmental concerns highlighted in literature review – water use and quality, solid waste, energy and greenhouse gas emissions, chemical use, land use issues, the impact on ecosystems (Barber et al., 2009; Christ and Burritt, 2013; Forbes et al., 2009; Gabzdylova et al., 2009) – were considered in the most part of frameworks. The topics more frequently engaged are biodiversity and soil management. Biodiversity is a specific chapter or an important part of most frameworks and can motivate specific programs, such as the BWI. Another interesting initiative in this sense is BioDiVine, a cross-country initiative to promote biodiversity in the wineyards (Guenser et al., 2012; IFVV, 2010). Moreover, it is directly related to guidelines and indicators of other issues such as surrounding areas and soil management. In turn, soil management is aligned with the agrochemicals use, summarizing a group of guidelines and indicators that include agricultural practices.

Table 6
Overview of wine sustainability frameworks content.

Country	Frameworks	Conceptual aspects			Environmental management											
		Economic sustainability of structures and territories	Product quality and safety	Heritage, historic, cultural, ecologic and aesthetic aspects	Site selection	Biodiversity	Variety selection	Solid waste	Soil management	Energy use	Water management	Air quality	Wastewater	Neighboring land use	Human resource management	Agrochemical use
South Africa	**Sustainable Wine South Africa** (SWSA)	X	X	X	X	X	X	X	X	X	X	X	X	X		X
	Integrated Production of Wine (IPW)		X	X	X	X	X	X	X	X	X	X	X	X		X
	Biodiversity & Wine Initiative (BWI)	X		X		X			X					X		
New Zealand	**Sustainable Winegrowing New Zealand** (SWNZ)		X			X		X	X	X	X	X	X	X	X	X
Australia	**McLaren Vale Sustainable Winegrowing Australia** (MVSWGA)	X	X	X		X		X	X		X				X	X
US/ California	**California Sustainable Winegrowing Alliance** (CSWA)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chile	**Código National de Sustentabilidad**	X				X		X	X	X	X	X	X		X	X
France	**Terra Vitis**		X	X	X	X		X	X	X	X	X	X	X	X	X

Guidelines and indicators related to eco-efficiency or the use of natural resources belong to a third group, which includes water factors, energy and waste. In this case, the main indicators used are records and reduce the consumption, disposal and alternative practices.

The social perspective is also covered in most of the frameworks, particularly considering the internal public level, with indicators in terms of quality of life at work and health and safety. The community involvement appears as an indicator evaluated in the case of the New Zealand national program, which includes the participation in programs related to biodiversity, as well as Australia and California that evaluate participation in programs and local associations in general. The exception is South Africa; despite being a consolidated and relatively well-detailed program, the framework is weak in terms of social indicators. This framework was considered, however, high educational potential, because of the detailing level on environmental management issues and the quality and safety of products, which are relevant in the context of the wine and can also be related to social aspects.

In terms of economic dimension, one of the factors used is the relationship between suppliers and 'green' criteria for products and purchasing. This approach is present in the frameworks from California and Chile. In both cases, it is a parallel with the standard of the GRI Sustainability Reporting, and the economic dimension is also evaluated with regard to market share and human resources indicators, such as hiring and salaries (CSWA, 2012; GRI, 2016;

Table 7
Wine sustainability guidelines and indicators.

	Content Category	Guidelines and Indicators
Conceptual aspects	Economic sustainability of structures and territories	• Relationship with suppliers and environmental criteria in products and services purchase • Relationship between winery and wine growers • Initiatives to promote certified products and producers
	Product quality and safety	• Food safety procedures and good oenological practice • Wine quality criteria
	Heritage, historical, cultural, ecological and aesthetic aspects	• Environmental Heritage Preservation • Preservation of wine heritage and landscape • Care and maintenance of facilities
Environmental management	Site selection	• Technical studies of local characteristics (soil and vegetation), especially for new vineyards
	Biodiversity	• Maintenance of conservation areas or native vegetation • Actions to monitor and track biodiversity • Actions to enhance biodiversity, related to surrounding areas or vineyard • Maintenance of ground cover • Participation in local programs for biodiversity promotion and preservation
	Variety selection	• Adaptation of varieties and choice of clones and rootstocks considering local conditions
	Solid waste	• Solid waste management program • Reduction and reuse • Waste selective collect and recycling • Final disposal • Packaging of chemicals and agrochemicals disposal • Special waste: toxic, oil, tires, etc.
	Soil management	• Soil management plan • Agricultural practices • Actions to erosion prevention and control • Nutrient and fertilizer • Vegetal cover • Identification and protection of watercourses and sensitive areas for water pollution
	Energy use	• Energy efficiency • Consumption registration and control • Renewable energy source • Fuels and machines in the vineyard • Lighting
	Water management	• Consumption registration and control • Irrigation (source, type, consumption, decision criteria and landscape irrigation) • Water quality control • Actions to reduce consumption
	Air quality	• Diffuse pollution and emissions of chemicals (regulation of sprays, for example) • Overall emissions reduction • Control and reduction of emissions of greenhouse gases and emissions from vehicles
	Wastewater	• Monitor and reduce wastewater generation • Treatment of winery wastewater • Agrochemical application equipment effluent washing
	Neighboring land use	• Environmental Management Plan for vineyard and neighboring areas • Preservation of native vegetation in surrounding areas • Reduce activities with negative impact on the environment (diffuse pollution from sprays and noise, etc.)
	Human resource management	• Health, safety and quality of life at work criteria (such as, use of personal protective equipment in the operations and accident prevention) • Recruitment and selection, respect for diversity • Training and environmental education
	Agrochemical use	• Rational use of chemicals • Elimination or reduction of herbicide use • Registration of applications • Storage and handling of chemicals, agrochemicals, fertilizers and other inputs • Diseases and pests control • Use of alternative farming practices to reduce agrochemicals

Vinos de Chile, 2014; Zucca et al., 2009). Another point is that the issue of sustainability integrates business strategy, which implies that such criteria are part of the operations and the evaluation as a whole, factors that are also highlighted by the California and Chile frameworks.

Some topics are discussed only at the level of general policy and fail to integrate the framework itself, in the form of guidelines or indicators, especially in terms of more conceptual topics or territorial aspects. Examples of this fact are the topics incorporating community values into sustainability strategy or to maintain the landscape and the wine heritage, in the California and France standards, respectively, just as level of general guidance, without guidelines or specific indicators. Besides conceptual and territorial aspects being subjective issues, therefore harder to assess in objective terms, this topics are more related with strategic decision, which is not yet the main proposition and scope of frameworks analyzed, more focused on operational issues. On the other hand, moving toward sustainability is already a strategic decision for the countries and the wine regions involved; in this sense, the evolution of frameworks and the field of sustainability assessment by improving this type of indicators can support more strategic analysis and decisions, enhancing sustainability in the wine industry.

4.2. Wine sustainability: main guidelines and indicators

Each framework represents a different way of reading and interpreting reality, considering this broad concept that is sustainability. Even if the contexts are different, considering edaphoclimatic conditions, as well as, institutional and sociocultural aspects, the survey looked for identifying common grounds in the frameworks studied. In this sense, the main and most frequent guidelines and indicators used to characterize and measure sustainability in the wine industry were highlighted, considering the content categories used in this survey. Table 7 summarizes this cross-analysis.

Sustainability frameworks propose a dialogue between whole vision and specific indicators. Also, it is an exercise to put sustainability issues in a context, guiding and motivating stakeholders. Some criteria are global and/or broader, covering other industries or sectors of society (such as, human resources or biodiversity), while others are more focused on agriculture or wine industry issues. In addition to that, some guidelines and indicators are part of legal requirements, such as quality and safety, and cannot be considered alone as sustainability indicators. So, in terms of content, the cross-analysis highlight the importance of consider a set of guidelines and indicators to assess sustainability and cover main issues, which is aligned with further studies (Capri et al., 2013; Parris and Kates, 2003).

It is important to consider that sustainability issues can be quite different, according to the context. Even so, the cross-analysis shows a convergence in the main criteria adopted by the frameworks. In this sense, sustainability programs, goals and parameters should consider local conditions, which make hard the proposition of general guidelines to sustainability assessment. However, it is necessary to move forward in the theme and systematize the current practices and guidelines in a common basis can contribute to the development of sustainability programs, to improve current methods and to encourage the diffusion of sustainability practices to the individuals or in terms of national programs.

5. Conclusions

Frameworks have the function of systematizing a proposed approach to sustainable winegrowing, in a certain context, setting parameters for recognition and communication. In this process, it is delimited an official view on the subject, which ultimately lists priorities. So, as long as the protocols have as a backdrop the same theme, sustainable viticulture, its scope and its structure and parameters considered can vary substantially. This paper analyzed different proposals in terms of geographical distribution and scope. Although six different countries were analyzed, common grounds could be observed in the approaches to wine sustainability, considering contents and form. In fact, most of the frameworks end up reflecting the main sustainability issues and environment concerns.

The analysis performed allows a cross-country overview about wine sustainability frameworks, in terms of structure, scale, scope, deepness and content, on the same basis. The question of what sustainability in the wine world is was answered featuring official definitions, current practices (the frameworks) and main guidelines and indicators. It complements the current literature linking the frameworks content with official definition and guidelines from OIV and summarizing the main guidelines and indicators adopted by national (or regional programs). These common grounds can indicate some directions in order to improve wine sustainability frameworks and develop common guidelines that allow assessment and comparison among different wine producers.

While contributing to the research on wine sustainability assessment, the research presented in this paper has a number of limitations. The lack of empirical data from stakeholders of wine regions analyzed has limited some analysis, especially considering local impacts. Further works using empirical data can better develop some subjects, such as, the role of institutions and the internal drives to participate in sustainability programs. In addition, it is important to follow-up current initiatives, highlighting critical success factors to the continuity and the adherence of stakeholders. Also, the learning potential criterion can be better developed using empirical evidences.

Sustainable viticulture frameworks can be treated as an answer of wine territories to customers and markets, a way to highlight and systematize current practices or an initiative to improve wine management and promote innovation processes. Furthermore, the frameworks are a way of positioning the wine territory to markets and customers. In this sense, the latest documents from OIV and the advance in sustainability assessment as a whole tend to guide the frameworks toward more effective proposition for improving wine sustainability, in order to answer to the operational challenges with a strategic thinking.

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